



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

RESTOR METROLOGY
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CALIBRATION

Valid To: January 31, 2013

Certificate Number: 3088.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ² (±)	Comments
Micrometers & Calipers ³	Up to 8 inches	$(49 + 1.6L) \mu\text{in} + 0.6R$	Mitutoyo 516-423-26 grade 1 gage block set L = gage block stack length R = UUT resolution

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
DC Voltage – Generate ^{3,4}	Up to 220 mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	7.5 $\mu\text{V}/\text{V} + 0.4 \mu\text{V}$ 5.0 $\mu\text{V}/\text{V} + 1.0 \mu\text{V}$ 3.5 $\mu\text{V}/\text{V} + 3.1 \mu\text{V}$ 3.5 $\mu\text{V}/\text{V} + 8.1 \mu\text{V}$ 5.0 $\mu\text{V}/\text{V} + 83 \mu\text{V}$ 6.5 $\mu\text{V}/\text{V} + 680 \mu\text{V}$	Fluke 5700A/EP

Parameter/Equipment	Range	CMC ^{2, 11} (\pm)	Comments
DC Voltage – Measure ^{3,5}	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	5.8 μ V/V + 0.4 μ V 4.7 μ V/V + 0.5 μ V 5.0 μ V/V + 2.5 μ V 7.0 μ V/V + 52 μ V 21 μ V/V + 600 μ V	Agilent 3458A w/ opt 002
High Voltage – Measure ³	(1 to 20) kV DC (21 to 70) kV DC (20 to 100) Hz (50 to 60) Hz	0.050 % + 6 V 0.050 % + 27 V 0.24 % + 19 Vrms 0.47 % + 71 Vrms	Vitrek 4670B
DC Current – Generate ^{3,4}	Up to 220 μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 11) A (11 to 20) A	40 μ A/A + 6.0 nA 35 μ A/A + 7.6 nA 35 μ A/A + 48 nA 55 μ A/A + 740 nA 0.013 % + 13 μ A 0.036 % + 850 μ A 0.1 % + 760 μ A	Fluke 5700A/EP Fluke 5725A Fluke 5520A
DC Current – Measure ^{3,5}	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 30) A (30 to 100) A (100 to 600) A	41 μ A/A + 1.0 nA 39 μ A/A + 7.1 nA 39 μ A/A + 69 nA 53 μ A/A + 680 nA 0.014 % + 13 μ A 0.35 % 0.012 % 0.051 %	Agilent 3458A w/ opt 002 Agilent 34330A Empro LAB 100-50 Empro LAB 600-50

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate ^{3,4}			
Up to 22 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 4 μV 90 μV/V + 4 μV 80 μV/V + 4 μV 0.020 % + 4 μV 0.050 % + 5 μV 0.11 % + 10 μV 0.14 % + 20 μV 0.27 % + 20 μV	Fluke 5700A/EP
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 13 μV 90 μV/V + 7.5 μV 80 μV/V + 7.5 μV 0.020 % + 7.5 μV 0.046 % + 18 μV 0.090 % + 21 μV 0.14 % + 26 μV 0.27 % + 46 μV	
(0.22 to 2.2) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 45 μV 90 μV/V + 25 μV 45 μV/V + 21 μV 75 μV/V + 22 μV 0.011 % + 82 μV 0.042 % + 110 μV 0.10 % + 220 μV 0.17 % + 310 μV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 440 μV 90 μV/V + 240 μV 45 μV/V + 190 μV 75 μV/V + 110 μV 0.010 % + 590 μV 0.028 % + 810 μV 0.10 % + 2100 μV 0.15 % + 3300 μV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.024 % + 4.4 mV 90 μV/V + 2.3 mV 52 μV/V + 1.8 mV 80 μV/V + 1.9 mV 0.015 % + 5.3 mV 0.090 % + 17 mV 0.44 % + 41 mV 0.80 % + 81 mV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Generate ^{3,4} (cont)			
(220 to 250) V	(15 to 50) Hz 50 Hz to 1 kHz	0.030 % + 17 mV 70 μV/V + 3.9 mV	Fluke 5725A
(220 to 1100) V	40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	90 μV/V + 5.3 mV 0.017 % + 6.8 mV 0.060 % + 12 mV	
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.060 % + 12 mV 0.23 % + 46 mV	
AC Voltage Flatness – Generate ^{3,4} (Referenced to 1 kHz)			
0.3 mV to 3.5 V	(10 to 30) Hz 30 Hz to 120 kHz	0.35 % 0.12 %	Fluke 5700A/EP-03
(0.3 to 1.1) mV	120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.24 % + 3 μV 0.47 % + 3 μV 0.7 % + 3 μV 1.8 % + 15 μV	
(1.1 to 3) mV	120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.12 % + 3 μV 0.35 % + 3 μV 0.58 % + 3 μV 1.8 % + 3 μV	
3 mV to 3.5 V	120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.12 % + 3 μV 0.24 % + 3 μV 0.47 % + 3 μV 1.2 % + 3 μV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Voltage – Measure ^{3,5} (cont)			
(1 to 10) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	91 μV/V + 140 μV 91 μV/V + 140 μV 0.017 % + 140 μV 0.035 % + 140 μV 0.093 % + 140 μV 0.35 % + 160 μV 0.12 % + 160 μV 0.18 % + 160 μV	Agilent 3458A w/ opt 002 in synchronous sub- sampled AC volts mode ACBAND < 2 MHz
(11 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.045 % + 2.7 mV 0.045 % + 2.7 mV 0.045 % + 2.7 mV 0.056 % + 2.7 mV 0.15 % + 2.7 mV 0.47 % + 2.7 mV 1.8 % + 2.7 mV	
(100 to 750) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.046 % + 47 mV 0.046 % + 24 mV 0.069 % + 24 mV 0.14 % + 24 mV 0.35 % + 24 mV	
Up to 10 mV	45 Hz to 100 kHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz	0.1 % + 7.5 μV 1.4 % + 6.5 μV 8.1 % + 8.6 μV 24 % + 9.7 μV	
11 mV to 10 V	45 Hz to 100 kHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.1 % + 700 μV 2.4 % + 580 μV 4.7 % + 810 μV 4.7 % + 930 μV 18 % + 1.2 mV	
(11 to 100) V	45 Hz to 100 kHz	0.15 % + 2.7 mV	
(100 to 750) V	45 Hz to 100 kHz	0.35 % + 120 mV	

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Generate ^{3,4}			
Up to 220 µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 16 nA 0.016 % + 10 nA 0.012 % + 8 nA 0.028 % + 12 nA 0.11 % + 65 nA	Fluke 5700A/EP
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 40 nA 0.016 % + 36 nA 0.012 % + 36 nA 0.020 % + 110 nA 0.11 % + 650 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 410 nA 0.016 % + 360 nA 0.012 % + 360 nA 0.020 % + 560 nA 0.11 % + 5100 nA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 4.1 µA 0.016 % + 3.6 µA 0.012 % + 2.6 µA 0.020 % + 3.6 µA 0.11 % + 11 µA	
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 36 µA 0.045 % + 81 µA 0.70 % + 180 µA	
(2.2 to 11) A	40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.046 % + 210 µA 0.095 % + 400 µA 0.36 % + 760 µA	Fluke 5700A/EP with 5725A
(11 to 20) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.12 % + 5 mA 0.15 % + 5 mA 3.0 % + 5 mA	Fluke 5520A

Parameter/Range	Frequency	CMC ² (±)	Comments
AC Current – Measure ^{3,5}			
Up to 100 µA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 5 kHz	0.47 % + 35 nA 0.18 % + 35 nA 0.070 % + 35 nA	Agilent 3458A w/ opt 002
(0.1 to 1) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.47 % + 240 nA 0.18 % + 240 nA 0.070 % + 240 nA 0.035 % + 240 nA 0.070 % + 240 nA 0.047 % + 470 nA 0.64 % + 1800 nA	
(1 to 10) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.47 % + 2.3 µA 0.18 % + 2.3 µA 0.070 % + 2.3 µA 0.035 % + 2.3 µA 0.070 % + 2.3 µA 0.47 % + 4.6 µA 0.64 % + 18 µA	
(10 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz 5 to 20 kHz 20 to 50 kHz 50 to 100 kHz	0.47 % + 43 µA 0.18 % + 38 µA 0.070 % + 43 µA 0.035 % + 24 µA 0.070 % + 43 µA 0.47 % + 55 µA 0.64 % + 180 µA	
100 mA to 1.05 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.47 % + 240 µA 0.19 % + 240 µA 0.12 % + 240 µA 0.36 % + 240 µA 0.36 % + 240 µA 1.2 % + 470 µA	
(1 to 2) A (2 to 20) A (20 to 100) A	45 Hz to 1 kHz	0.16 % + 150 µA 0.16 % + 1.5 mA 0.16 % + 15 mA	

Parameter/Range	Frequency	CMC ² (±)	Comments
Resistance – Generate ^{3,4} , Fixed Points	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	73 μΩ 130 μΩ 190 μΩ 250 μΩ 1.5 mΩ 1.7 mΩ 2.4 mΩ 8.5 mΩ 17 mΩ 86 mΩ 200 mΩ 1.7 Ω 2.2 Ω 21 Ω 41 Ω 410 Ω 0.9 kΩ 14 kΩ	Fluke 5700A/EP
Resistance – Generate ³	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (0.33 to 1.1) GΩ	40 μΩ/Ω + 1 mΩ 30 μΩ/Ω + 1.5 mΩ 28 μΩ/Ω + 1.4 mΩ 28 μΩ/Ω + 2 mΩ 28 μΩ/Ω + 2 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 20 mΩ 28 μΩ/Ω + 0.2 Ω 28 μΩ/Ω + 0.2 Ω 32 μΩ/Ω + 2 Ω 32 μΩ/Ω + 2 Ω 60 μΩ/Ω + 30 Ω 0.013 % + 50 Ω 0.025 % + 2.5 kΩ 0.050 % + 3.1 kΩ 0.3 % + 104 kΩ 1.5 % + 522 kΩ	Fluke 5520A
Resistance – Measure ^{3,5}	(1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ	18 μΩ/Ω + 130 μΩ 15 μΩ/Ω + 1.1 mΩ 13 μΩ/Ω + 1.0 mΩ 12 μΩ/Ω + 7.7 mΩ 12 μΩ/Ω + 320 mΩ 18 μΩ/Ω + 7.1 Ω 59 μΩ/Ω + 46 Ω 0.058 % + 5.7 kΩ 0.59 % + 0.11 MΩ	Agilent 3458A w/ opt 002

Parameter/Range	Frequency	CMC ² (±)	Comments
Capacitance – Generate ³			Fluke 5520A
(0.19 to 1.1) nF	10 Hz to 10 kHz	0.5 % + 10 pF	
(1.1 to 3.3) nF	10 Hz to 3 kHz	0.5 % + 10 pF	
(3.3 to 11) nF	10 Hz to 1 kHz	0.25 % + 10 pF	
(11 to 110) nF	10 Hz to 1 kHz	0.25 % + 0.1 nF	
(110 to 330) nF	10 Hz to 1 kHz	0.25 % + 0.3 nF	
(0.33 to 1.1) μF	(10 to 600) Hz	0.25 % + 1.1 nF	
(1.1 to 3.3) μF	(10 to 300) Hz	0.25 % + 3.3 nF	
(3.3 to 11) μF	(10 to 150) Hz	0.25 % + 11 nF	
(11 to 33) μF	(10 to 120) Hz	0.4 % + 30 nF	
(33 to 110) μF	(10 to 80) Hz	0.45 % + 109 nF	
(110 to 330) μF	(0 to 50) Hz	0.45 % + 330 nF	
(0.33 to 1.1) mF	(0 to 20) Hz	0.45 % + 1.1 μF	

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature Indicators – Thermocouple ³			Fluke 5520A
Type “B”	(600 to 800) °C	0.44 °C	
	(800 to 1000) °C	0.34 °C	
	(1000 to 1550) °C	0.30 °C	
	(1550 to 1820) °C	0.33 °C	
Type “E”	(-250 to -100) °C	0.50 °C	
	(-100 to -25) °C	0.16 °C	
	(-25 to 350) °C	0.14 °C	
	(350 to 650) °C	0.16 °C	
	(650 to 1000) °C	0.21 °C	
Type “J”	(-210 to -100) °C	0.27 °C	
	(-100 to -30) °C	0.16 °C	
	(-30 to 150) °C	0.14 °C	
	(150 to 760) °C	0.17 °C	
	(760 to 1200) °C	0.23 °C	
Type “K”	(-200 to -100) °C	0.33 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.16 °C	
	(120 to 1000) °C	0.26 °C	
	(1000 to 1372) °C	0.40 °C	
Type “N”	(-200 to -100) °C	0.40 °C	
	(-100 to -25) °C	0.22 °C	
	(-25 to 120) °C	0.19 °C	
	(120 to 410) °C	0.18 °C	
	(410 to 1300) °C	0.27 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments	
Temperature Indicators – Thermocouple ³ (cont)				
Type “R”	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.40 °C	Fluke 5520A	
Type “S”	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C		
Type “T”	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C		
Temperature Indicators – RTD ³				
Pt 385 (100 Ω)	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C 0.23 °C		Fluke 5520A
Pt 3926 (100 Ω)	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.05 °C 0.07 °C 0.09 °C 0.10 °C 0.12 °C		
Pt 3916 (100 Ω)	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.25 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.08 °C 0.09 °C 0.10 °C 0.23 °C		
Pt 385 (200 Ω)	(-200 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C		

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature Indicators – RTD ³ (cont)			
Pt 385 (500 Ω)	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.04 °C 0.05 °C 0.06 °C 0.08 °C 0.09 °C 0.11 °C	Fluke 5520A
Pt 385 (1000 Ω)	(-200 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 600) °C (600 to 630) °C	0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.23 °C	
PtNi 385 (120 Ω) (Ni 120)	(-80 to 100) °C (100 to 260) °C	0.08 °C 0.14 °C	
Cu 427 (10 Ω)	(-100 to 260) °C	0.3 °C	

Parameter/Range	Frequency	CMC ² (±)	Comments
Oscilloscope Voltage – Generate ³			
DC Signal Into 50 Ω Into 1 MΩ	(-6.6 to 6.6) V (-130 to 130) V	0.25 % + 41 μV 0.050 % + 41 μV	Fluke 5520A w/SC1100
Squarewave Into 50 Ω, 1.8 mV to 6.6 V _(p-p)	10 Hz to 10 kHz	0.25 % + 41 μV	
Into 1 MΩ 1.8 mV to 105 V _(p-p)	10 Hz to 10 kHz	0.10 % + 41 μV	

Parameter/Range	Frequency	CMC ² (±)	Comments
Oscilloscope Leveled Sine Wave – 50 Ω Generate ³ 5 mV to 5.5 V _(p-p) Amplitude Flatness (Relative to 50 kHz) 5 mV to 5.5 V 5 mV to 3.5 V	50 kHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	2.0 % + 300 μV 3.5 % + 300 μV 4.0 % + 300 μV 6.0 % + 300 μV 7.0 % + 300 μV 1.5 % + 100 μV 2.0 % + 100 μV 4.0 % + 100 μV 5.0 % + 100 μV	Fluke 5520A w/SC1100
Scope Time Marker – Generate ³ Into 50 Ω	5 s to 50 ms 20 ms to 2 ns	25 μs/s + (t*x1000) μHz 2.5 μs/s	Fluke 5520A w/SC1100 <i>t</i> = time in seconds
Distortion – Measure ³ Fundamental Frequency 20 Hz to 20 kHz (20 to 100) kHz	(0 to -99) dB (0 to -99) dB	1.2 dB 2.3 dB	Agilent 8903B

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Absolute Power – Generate ^{3,6}			
Into 50 Ω (10 to 3) V p-p	0.001 Hz to 100 kHz SWR 1.2:1	0.13 dB	Agilent 3325B
2.99 V to 1 mV p-p	0.001 Hz to 100 kHz SWR 1.2:1	0.24 dB	
(10 to 3) V p-p	100 kHz to 20 MHz SWR ≤ 1.2:1	0.47 dB	
2.999 V to 1 mV p-p	100 kHz to 10 MHz SWR ≤ 1.2:1	0.70 dB	
(2.999 to 0.1) V p-p	(10 to 20) MHz SWR ≤ 1.2:1	0.70 dB	
(99.99 to 1) mV	(10 to 20) MHz SWR ≤ 1.2:1	1.1 dB	
RF Absolute Power – Generate ^{3,6}			
Into 50 Ω, 13.01 dBm	1 kHz to 25 MHz 200 Hz to 80 MHz	0.12 dB 0.19 dB	Agilent 3335A
Into 75 Ω, 13.01 dBm	1 kHz to 25 MHz 200 Hz to 80 MHz	0.12 dB 0.19 dB	
Into 50 Ω, In 2 dB steps (Relative to Full Output)			
(0 to -38) dBm	200 Hz to 80 MHz	0.22 dB	
(-40 to -58) dBm	200 Hz to 80 MHz	0.22 dB	
(-60 to -98) dBm	200 Hz to 80 MHz	0.28 dB	
Into 75 Ω, In 2 dB steps (Relative to Full Output)			
0 to -38 dBm	200 Hz to 25 MHz (25 to 80) MHz	0.23 dB 0.34 dB	
-40 to -58 dBm	200 Hz to 25 MHz (25 to 80) MHz	0.28 dB 0.44 dB	
-60 to -98 dBm	200 Hz to 25 MHz (25 to 80) MHz	0.39 dB 0.69 dB	

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Absolute Power – Generate ^{3,6} (cont)			
Into 50 Ω (+8 to -10) dBm	10 MHz to 2 GHz SWR ≤ 1.6:1	0.70 dB	Agilent 83650B
	(2 to 20) GHz SWR ≤ 1.6:1	0.81 dB	
(+3 to -10) dBm	(20 to 40) GHz SWR ≤ 1.8:1	1.1 dB	
(0 to -10) dBm	(40 to 50) GHz SWR ≤ 2:1	2.0 dB	
(-10 to -60) dBm	10 MHz to 2 GHz SWR ≤ 1.6:1	1.1 dB	
	(2 to 20) GHz SWR ≤ 1.6:1	1.2 dB	
	(20 to 40) GHz SWR ≤ 1.8:1	1.4 dB	
	(40 to 50) GHz SWR ≤ 2:1	2.4 dB	
≤ -60 dBm	10 MHz to 2 GHz SWR ≤ 1.6:1	1.7 dB	
	(2 to 20) GHz SWR ≤ 1.6:1	1.8 dB	
	(20 to 40) GHz SWR ≤ 1.8:1	2.0 dB	
	(40 to 50) GHz SWR ≤ 2:1	2.9 dB	
RF Absolute Power – Measure ^{3,6}			
1 mW, 50 Ω	50 MHz	0.025 dB	Agilent 432A w/Agilent 478A-H76
(+20 to -30) dBm, 75 Ω	(100 to 600) kHz SWR ≤ 1.8:1	0.082 dB	Agilent E4419B w/Agilent 8483A-H84
	600 kHz to 2 GHz SWR ≤ 1.18:1	0.086 dB	

Parameter/Range	Frequency	CMC ² (±)	Comments	
RF Absolute Power – Measure ^{3,6} (cont)	(+20 to -30) dBm, 50 Ω	(100 to 300) kHz SWR ≤ 1.6:1	0.068 dB	Agilent E4419B w/Agilent 8482A-H84
		300 kHz to 1 MHz SWR ≤ 1.2:1	0.067 dB	
		1 MHz to 2 GHz SWR ≤ 1.1:1	0.067 dB	
		(2 to 4.2) GHz SWR ≤ 1.3:1	0.067 dB	
	(-20 to -70) dBm, 50 Ω	(10 to 30) MHz SWR ≤ 1.4:1	0.075 dB	Agilent E4419B w/Agilent 8481D-H84
		30 MHz to 4 GHz SWR ≤ 1.15:1	0.076 dB	
		(4 to 10) GHz SWR ≤ 1.21:1	0.083 dB	
		(10 to 15) GHz SWR ≤ 1.3:1	0.083 dB	
		(15 to 18) GHz SWR ≤ 1.35:1	0.084 dB	
	(+20 to -30) dBm, 50 Ω	(50 to 100) MHz SWR ≤ 1.15:1	0.083 dB	Agilent E4419B w/Agilent 8487A-H84
		100 MHz to 2 GHz SWR ≤ 1.1:1	0.085 dB	
		(2 to 12.4) GHz SWR ≤ 1.15:1	0.093 dB	
		(12.4 to 18) GHz SWR ≤ 1.2:1	0.094 dB	
		(18 to 26.5) GHz SWR ≤ 1.25:1	0.099 dB	
		(26.5 to 40) GHz SWR ≤ 1.4:1	0.12 dB	
		(40 to 50) GHz SWR ≤ 1.5:1	0.17 dB	
	(-20 to -70) dBm, 50 Ω	(50 to 100) MHz SWR ≤ 1.19:1	0.083 dB	Agilent E4419B w/Agilent 8487D-H84
		100 MHz to 2 GHz SWR ≤ 1.15:1	0.085 dB	
		(2 to 12.4) GHz SWR ≤ 1.2:1	0.093 dB	
(12.4 to 18) GHz SWR ≤ 1.29:1		0.094 dB		
(18 to 26.5) GHz SWR ≤ 1.37:1		0.099 dB		

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Absolute Power – Measure ^{3,6} (cont)			
(-20 to -70) dBm, 50 Ω	(26.5 to 40) GHz SWR ≤ 1.61:1	0.12 dB	Agilent E4419B w/Agilent 8487D-H84
	(40 to 50) GHz SWR ≤ 1.86:1	0.17 dB	
(+30 to -20) dBm, 50 Ω	100 kHz to 2.6 GHz SWR ≤ 1.15:1	0.082 dB	Agilent 8902A w/Agilent 11722A
(±30 to -20) dBm, 50 Ω	50 MHz to 1.3 GHz SWR ≤ 1.15:1	0.078 dB	Agilent 8902A w/Agilent 11792A
	(1.3 to 18) GHz SWR ≤ 1.25:1	0.094 dB	
	(18 to 26.5) GHz SWR ≤ 1.4:1	0.11 dB	
RF Attenuation – Generate ³			
Coaxial, 1 dB Step (0 to 11) dB			
0 dB	10 MHz to 1 GHz (1 to 18) GHz	0.01 dB 0.049 dB	Agilent 8494H
1 dB	10 MHz to 1 GHz (1 to 18) GHz	0.01 dB 0.049 dB	
2 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
3 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
4 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
5 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
6 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
7 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Attenuation – Generate ³ (cont)			
8 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	Agilent 8494H
9 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
10 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
11 dB	10 MHz to 1 GHz (1 to 18) GHz	0.052 dB 0.071 dB	
Coaxial, 10 dB Step (0 to 110) dB			
0 dB	10 MHz to 1 GHz (1 to 18) GHz	0.01 dB 0.049 dB	Agilent 8496H
10 dB	10 MHz to 1 GHz (1 to 18) GHz	0.024 dB 0.053 dB	
20 dB	10 MHz to 1 GHz (1 to 18) GHz	0.052 dB 0.071 dB	
30 dB	10 MHz to 1 GHz (1 to 18) GHz	0.074 dB 0.088 dB	
40 dB	10 MHz to 1 GHz (1 to 18) GHz	0.11 dB 0.12 dB	
50 dB	10 MHz to 1 GHz (1 to 18) GHz	0.14 dB 0.15 dB	
60 dB	10 MHz to 1 GHz (1 to 18) GHz	0.16 dB 0.16 dB	
70 dB	10 MHz to 1 GHz (1 to 18) GHz	0.2 dB 0.2 dB	
80 dB	10 MHz to 1 GHz (1 to 18) GHz	0.22 dB 0.23 dB	
90 dB	10 MHz to 1 GHz (1 to 18) GHz	0.24 dB 0.25 dB	

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Attenuation – Generate ³ (cont)			
100 dB	10 MHz to 1 GHz (1 to 18) GHz	0.26 dB 0.27 dB	Agilent 8496H
110 dB	10 MHz to 1 GHz (1 to 18) GHz	0.32 dB 0.32 dB	
Tuned RF Power, Absolute – Measure ^{3,7}			
(≤ +10 to ≥ -22) dBm (< -22 to ≥ -42) dBm (< -42 to ≥ -50) dBm (< -50 to ≥ -60) dBm (< -60 to ≥ -72) dBm (< -72 to ≥ -80) dBm (< -80 to ≥ -92) dBm (< -92 to ≥ -102) dBm (< -102 to ≥ -110) dBm (< -110 to ≥ -120) dBm (< -120 to ≥ -127) dBm	2.5 MHz to 26.5 GHz	0.15 dB 0.16 dB 0.18 dB 0.18 dB 0.2 dB 0.22 dB 0.23 dB 0.24 dB 0.26 dB 0.3 dB 0.34 dB	Agilent 8902A with Agilent 11722A or Agilent 11792A and Agilent 11793A
Tuned RF Power, Relative – Measure ^{3,7}			
(≤ +10 to ≥ +2) dBm (< + 2 to ≥ -12) dBm (< -12 to ≥ -22) dBm (< -22 to ≥ -31) dBm (< -31 to ≥ -40) dBm (< -40 to ≥ -50) dBm (< -50 to ≥ -61) dBm (< -61 to ≥ -71) dBm (< -71 to ≥ -80) dBm (< -80 to ≥ -90) dBm (< -90 to ≥ -100) dBm (< -100 to ≥ -110) dBm (< -110 to ≥ -120) dBm (< -120 to ≥ -127) dBm	2.5 MHz to 26.5 GHz	0.083 dB 0.067 dB 0.077 dB 0.091 dB 0.1 dB 0.12 dB 0.13 dB 0.15 dB 0.17 dB 0.18 dB 0.2 dB 0.22 dB 0.26 dB 0.31 dB	Agilent 8902A with Agilent 11722A or Agilent 11792A and Agilent 11793A

Parameter/Range	Frequency	CMC ² (±)	Comments
Amplitude Modulation – Measure^{3,8} (0.15 to 10) MHz (5% to < 10%) AM (10% to 99%) AM (5% to < 10%) AM (10% to 99%) AM (10 to 1300) MHz (5% to < 10%) AM (10% to 99%) AM (5% to < 10%) AM (10% to 99%) AM 1300 MHz to 26.5 GHz (5% to < 10%) AM (10% to 99%) AM 10 MHz to 26.5 GHz (5% to < 10%) AM (10% to 99%) AM	Rate: 50 Hz to 10 kHz, Depth: 5% to 99% Rate: 20 Hz to 10 kHz, Depth: to 99% Rate: 50 Hz to 50 kHz, Depth: 5% to 99% Rate: 20 Hz to 10 kHz, Depth: to 99% Rate: 50 Hz to 10 kHz, Depth: 5% to 99% Rate: 20 Hz to 10 kHz, Depth: to 99%	0.023 AM + 0.03 % 0.023 AM + 0.11 % 0.035 AM + 0.03 % 0.035 AM + 0.11 % 0.012 AM + 0.03 % 0.012 AM + 0.11 % 0.035 AM + 0.03 % 0.035 AM + 0.11 % 0.018 AM + 0.04 % 0.018 AM + 0.13 % 0.035 AM + 0.04 % 0.035 AM + 0.13 %	Agilent 8902A Agilent 8902A with Agilent 11793A, Ext. LO generator
Frequency Modulation – Measure^{3,9} (0.25 to 10) MHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (10 to 1300) MHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM (10 to 1300) MHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM	Rate: 20 Hz to 10 kHz, ≤40 kHz pk Rate: 50 Hz to 100 kHz, ≤400 kHz pk Rate: 20 Hz to 200 kHz, ≤400 kHz pk	0.024 FM + 3.3 Hz Pk 0.024 FM + 13 Hz Pk 0.012 FM + 3.3 Hz Pk 0.012 FM + 13 Hz Pk 0.012 FM + 120 Hz Pk 0.058 FM + 3.3 Hz Pk 0.058 FM + 13 Hz Pk 0.058 FM + 120 Hz Pk	Agilent 8902A

Parameter/Range	Frequency	CMC ² (±)	Comments
<p>Frequency Modulation – Measure³⁹ (cont)</p> <p>10 MHz to 26.5 GHz 10 MHz to 1.3 GHz (0 to <4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>(>1.3 to 6.2) GHz (0 to <4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>(>6.2 to 12.4) GHz (0 to <4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>(>12.4 to 18.6) GHz (0 to <4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>(>18.6 to 26.5) GHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>10 MHz to 26.5 GHz 10 MHz to 1.3 GHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>(>1.3 to 6.2) GHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>(>6.2 to 12.4) GHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p> <p>(>12.4 to 18.6) GHz (0 to < 4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM</p>	<p>Rate: 50 Hz to 100 kHz, ≤400 kHz pk</p>	<p>0.012 FM + 3.9 Hz Pk 0.012 FM + 13 Hz Pk 0.012 FM + 110 Hz Pk</p> <p>0.012 FM + 27 Hz Pk 0.012 FM + 36 Hz Pk 0.012 FM + 130 Hz Pk</p> <p>0.012 FM + 50 Hz Pk 0.012 FM + 59 Hz Pk 0.012 FM + 150 Hz Pk</p> <p>0.012 FM + 72 Hz Pk 0.012 FM + 81 Hz Pk 0.012 FM + 180 Hz Pk</p> <p>0.012 FM + 94 Hz Pk 0.012 FM + 110 Hz Pk 0.012 FM + 200 Hz Pk</p> <p>0.058 FM + 3.9 Hz Pk 0.058 FM + 13 Hz Pk 0.058 FM + 110 Hz Pk</p> <p>0.058 FM + 27 Hz Pk 0.058 FM + 36 Hz Pk 0.058 FM + 130 Hz Pk</p> <p>0.058 FM + 50 Hz Pk 0.058 FM + 59 Hz Pk 0.058 FM + 150 Hz Pk</p> <p>0.058 FM + 72 Hz Pk 0.058 FM + 81 Hz Pk 0.058 FM + 180 Hz Pk</p>	<p>Agilent 8902A with Agilent 11793A, Ext. LO generator</p>

Parameter/Range	Frequency	CMC ² (±)	Comments
Frequency Modulation – Measure ^{3,9} (cont) (>18.6 to 26.5) GHz (0 to <4) kHz Pk FM (≥ 4 to < 40) kHz Pk FM (≥ 40 to < 400) kHz Pk FM	Rate: 20 Hz to 200 kHz, ≤400 kHz pk	0.058 FM + 94 Hz Pk 0.058 FM + 110 Hz Pk 0.058 FM + 200 Hz Pk	Agilent 8902A with Agilent 11793A, Ext. LO generator
Phase Modulation – Measure ^{3,10} 150 kHz to 10 MHz (0 to <4) Rad Pk PM (≥ 4 to < 40) Rad Pk PM 10 MHz to 1.3 GHz (0 to <4) Rad Pk PM (≥ 4 to < 40) Rad Pk PM (≥ 40 to < 400) Rad Pk FM 1.3 to 26.5 GHz (0 to <4) Rad Pk PM (≥ 4 to < 40) Rad Pk PM (≥ 40 to < 400) Rad Pk FM	200 Hz to 10 kHz Rate ≤40 Rad Pk 200 Hz to 20 kHz Rate ≤400 Rad Pk 200 Hz to 20 kHz Rate ≤400 Rad Pk	4.7 % + 0.002 Rad 4.7 % + 0.016 Rad 3.5 % + 0.002 Rad 3.5 % + 0.016 Rad 3.5 % + 0.17 Rad 3.5 % + 0.002 Rad 3.5 % + 0.016 Rad 3.5 % + 0.17 Rad	Agilent 8902A Agilent 8902A with Agilent 11793A, Ext. LO generator
Digital Modulation ³ – Measure Carrier: 2 MHz to 2.65 GHz Error Vector Magnitude for Modulation Types: MSK, GMSK, BPSK, DQPSK, π/4DQPSK, 8PSK, 16QAM AND 32QAM, QPSK Phase Error for Modulation Types: MSK, GMSK, BPSK, DQPSK, π/4DQPSK, 8PSK, 16QAM AND 32QAM, QPSK Error Vector Magnitude for FSK Modulation	Mod Frequency Span: (1 to 100) kHz (0.1 to 1) MHz 1 MHz to 2.65 GHz (1 to 100) kHz (0.1 to 1) MHz 1 MHz to 2.65 GHz Mod Frequency: 3.2 kHz 1.152 kHz	0.33 % rms 0.51 % rms 1.0 % rms 0.18° rms 0.34° rms 0.57° rms 0.54 % rms 1.5 % rms	Agilent 89441A vector signal analyzer

Parameter/Equipment	Range	CMC ² (±)	Comments
Pulse – Generate ³			
Transition Time	10 % to 90 %	0.14 ns	Agilent 8133A
Width	150 ps to 10 ns	0.14 ns	
RMS Jitter – Period, Delay and Width	33 MHz to 3.0 GHz	7.6 ps	
Pulse – Measure ³			
RMS Jitter – Period, Delay and Width	Up to 50 GHz	9.3 ps + 0.1% Δ time reading	Agilent 86100C Agilent 86117A
Impulse Spectral Amplitude – Source ³			
CISPR Band A	(10 to 150) kHz	0.82 dB	Schwarzbeck IGUU 2916
CISPR Band B	150 kHz to 30 MHz	0.82 dB	
CISPR Band C and D	(30 to 1000) MHz	1.1 dB	
Sinewave Output for CISPR Checks – Source ³			
@ 60 dB/μV	100 kHz (1, 10 and 100) MHz	0.35 dB 0.35 dB	Schwarzbeck IGUU 2916
Peak and Average Detector Response ³	CISPR Band A through D	1.3 dB	Schwarzbeck IGUU 2916
LISN ³ –			
Insertion Loss	9 kHz to 108 MHz	0.09 dB	Agilent 4195A Agilent 41952A Agilent 85032F
Impedance	300 kHz to 108 MHz	1.8 %	
Phase	9 kHz to 108 MHz	± 1.2 deg	

Parameter/Range	Frequency	CMC ² (±)	Comments
CDN ³ –			
Insertion Loss	150 kHz to 230 MHz	0.09 dB	Agilent 4195A Agilent 41952A Agilent 85032F
Coupling Factor	150 kHz to 230 MHz	0.09 dB	
Impedance	150 kHz to 230 MHz	1.8 %	

Parameter/Equipment	Range	CMC ^{2,11} (±)	Comments
Thermal Noise Figure System ³ – Measure (0 to 30) dB	10 MHz to 1.6 GHz SWR 1.7:1 ENR (14 to 16) dB	0.21 dB	Agilent 8970B with 346C
Thermal Noise ³ Generate – ENR (14 to 16) dB	10 MHz to 18 GHz SWR 1.25:1 (18 to 26.5) GHz SWR 1.35:1	0.22 dB 0.22 dB	Agilent 346C
ESD Simulators ³ – Contact Voltage (Positive and Negative) Rise Time Peak Current 30 ns Current 60 ns Current	(1 to 30) kV (0.6 to 1) ns (3.75 to 33) A (2 to 20.8) A (1 to 10.4) A	2.2 % 58 ps 2.1 % 3.4 % 6.3 %	Agilent 54855A with EMTEST CTR 2 ESD Target with 20 dB attenuator

Parameter/Equipment	Range	CMC ^{2,11} (±)	Comments
ESD Simulators ³ – Air Discharge Voltage (Positive and Negative)	(1 to 30) kV	2.2%	Agilent 54855A with EMTEST CTR 2 ESD Target with 20 dB attenuator
Rise Time	(0.7 to 1) ns	58 ps	
RC Time Constant (at ± 15 KV)	600 ns ± 130 ns for 330 pF probe 300 ns ± 60 ns for 150 pf probe	58 ps 58 ps 58 ps	
EFT/Burst Generator ³ –			IEC 61000-4-6 Agilent 54845A with Haefely 249995 EFT Verification Set
Voltage (±)	10 V to 8 kV	2.9 %	
Rise Time	5 ns ± 30%	270 ps	
Impulse Duration	50 ns ± 30%	270 ps	
Burst Duration	15 ms ± 20%	270 ps	
Burst Period	300 ms ± 20%	270 ps	
Surge Generator ³ –			IEC 61000-4-5 IEC 61000-4-8 IEC 61000-4-9 IEC 61000-4-10 IEC 61000-4-11 IEC 61000-4-12 Agilent 54845A with Tektronix P6015A Pearson 110 Current Probe
Front Time (±)	(1.2 to 50) µs	270 ps	
Rise Time Open Circuit (±) Short Circuit (±)	(1.2 to 50) µs	270 ps	
Time to Half-Value (±)	(20 to 700) µs	270 ps	
Open Circuit Voltage (±)	10 V to 12 kV	2.9 %	
Short Circuit Voltage (±)	(0.125 to 3) kA	2.9 %	
Ring Wave Voltage	1 kV ± 10 %	2.9 %	
Ring Wave Rise Time	1.5 µs ± 0.5 µs	2.9 %	

Parameter/Range	Frequency	CMC ² (±)	Comments
Reflection S ₁₁ /S ₂₂ – Measure ³			
(0 to 1) lin	9 kHz to 1.3 GHz	(±0.005 to ±0.019) lin (±180 to ±1.1) deg	Agilent 8753ES Agilent 85032F
(0 to 1) lin	(1.3 to 3) GHz	(±0.006 to ±0.022) lin (±180 to ±1.3) deg	
(0 to 1) lin	(3 to 6) GHz	(±0.011 to ±0.035) lin (±180 to ±2.0) deg	Agilent 8753ES Agilent 85032F
(0 to 1) lin	40 MHz to 2 GHz	(±0.014 to ±0.039) lin (±180 to ±1.7) deg	Anritsu 37369A Anritsu 3652-1
(0 to 1) lin	(2 to 20) GHz	(±0.01 to ±0.034) lin (±180 to ±1.7) deg	
(0 to 1) lin	(20 to 40) GHz	(±0.012 to ±0.06) lin (±180 to ±2.2) deg	
Transmission S ₁₂ /S ₂₁ – Measure ³			
(0 to 20) dB	30 kHz to 1.3 GHz	(±0.049 to ±0.068) dB (±0.79 to ±0.82) deg	Agilent 8753ES Agilent 85032F
(20 to 40) dB		(±0.068 to ±0.088) dB (±0.82 to ±0.88) deg	
(40 to 60) dB		(±0.88 to ±0.13) dB (±0.88 to ±1.1) deg	
(0 to 20) dB	(1.3 to 3) GHz	(±0.054 to ±0.074) dB (±0.79 to ±0.84) deg	
(20 to 40) dB		(±0.074 to ±0.094) dB (±0.84 to ±0.90) deg	
(40 to 60) dB		(±0.094 to ±0.14) dB (±0.90 to ±1.1) deg	

Parameter/Range	Frequency	CMC ² (±)	Comments
Transmission S ₁₂ /S ₂₁ – Measure ³ (cont)			
(0 to 20) dB	(3 to 6) GHz	(±0.078 to ±0.099) dB (±0.83 to ±0.92) deg	Agilent 8753ES Agilent 85032F
(20 to 40) dB		(±0.099 to ±0.12) dB (±0.92 to ±1.1) deg	
(40 to 60) dB		(±0.12 to ±0.16) dB (±1.02 to ±1.2) deg	
(0 to 20) dB	40 MHz to 2 GHz	(±0.089 to ±0.1) dB (±0.61 to ±0.67) deg	Anritsu 37369A Anritsu 3652-1
(20 to 40) dB		(±0.089 to ±0.22) dB (±0.61 to ±1.5) deg	
(40 to 60) dB		(±0.089 to ±1.8) dB (±0.62 to ±14) deg	
(0 to 20) dB	(2 to 20) GHz	(±0.089 to ±0.18) dB (±0.61 to ±1.4) deg	
(20 to 40) dB		(±0.089 to ±0.18) dB (±0.61 to ±1.4) deg	
(40 to 60) dB		(±0.089 to ±0.30) dB (±0.62 to ±2.3) deg	
(0 to 20) dB	(20 to 40) GHz	(±0.18 to ±0.29) dB (±1.4 to ±2.5) deg	
(20 to 40) dB		(±0.18 to ±0.30) dB (±1.4 to ±2.5) deg	
(40 to 60) dB		(±0.18 to ±0.66) dB (±1.4 to ±5.0) deg	

IV. Mechanical

Parameter/Equipment	Range	CMC ² (±)	Comments
Torque – Measure ³	(5 to 50) in/lb (50 to 500) in/lb (10 to 100) ft/lb (100 to 750) ft/lb	0.58 % of rdg 0.29 % of rdg 0.29 % of rdg 0.29 % of rdg	Mountz LTT50i Mountz BMX500i Mountz BMX100F Mountz BMX1000F
Pressure – Measuring Equipment ³	Up to 3000 psig	0.017 % of rng + 0.025 % of rdg	Druck DPI320

V. Time and Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Time Interval – Measure ³	20 ps to 10 s	9.3 ps + 0.1% Δ time reading	Agilent 86100C Agilent 86117A
Frequency – Measuring Equipment	10 MHz Short-term Stability – (1 to 100) seconds Long-term Stability – per month	20 pHz/Hz 500 pHz/Hz	Symmetricom 4411A GPS disciplined oscillator
Frequency – Measure ³	1 Hz to 46 GHz	500 pHz/Hz	Agilent 53181A Agilent 5352B

¹ This laboratory offers commercial calibration service and field calibration service.

² Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of k = 2. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer’s device and to influences from the circumstances of the specific calibration.

³ Field calibration service is available for this calibration and this laboratory meets A2LA R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.

⁴ The measurands stated are generated with the Fluke 5700 series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

⁵ The measurands stated are measured with the HP 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.

⁶ CMC does not include mismatch.

⁷ Ranges are based upon the below combination used:

Instrument/System	Ranges
Agilent 8902A	2.5 MHz to 1.3 GHz Range 1, 2 – SWR 1.18:1 Range 3 – SWR 1.4:1
Agilent 8902A with Agilent 11722A	2.5 MHz to 1.3 GHz Range 1, 2 – SWR 1.33:1 Range 3 – SWR 1.5:1
Agilent 8902A with Agilent 11792A or Agilent 11793A	50 MHz to 1.3 GHz – SWR 1.15:1 1.3 to 18 GHz – SWR 1.25:1 18 to 26.5 GHz – SWR 1.4:1

⁸ CMCs are based upon the AM depths. For depths between 0% and 9.99%, digit resolution is 0.01%. For depths between 10% and 99%, digit resolution is 0.1%.

⁹ CMCs are based on a peak FM deviation. For deviations between 0 and 3.999 kHz, digit resolution is 1 Hz. For deviations between 4 and 39.99 kHz, digit resolution is 10 Hz. For deviations between 40 and 400 kHz, digit resolution is 100 Hz.

¹⁰ CMCs are based on a peak phase deviation. For deviations between 0 and 3.999 Rad, digit resolution is 0.001 Rad. For deviations between 4 and 39.99 Rad, digit resolution is 0.01 Rad. For deviations between 40 and 400 Rad, digit resolution is 0.1 Rad.

¹¹ In the statement of CMC, percentages are percentage of reading.



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Presented this 22nd day of October 2010.

A handwritten signature in black ink, appearing to read "Peter M. Meyer", written over a horizontal line.

President & CEO
For the Accreditation Council
Certificate Number 3088.01
Valid to January 31, 2013

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.